How did we assess the outcomes of tradable green certificates? A review

Anna Darmani, Annika Rickne, Antonio Hidalgo and Niklas Arvidsson

1 Introduction

Tradable Green Certificates (TGCs) schemes are among the most widespread policy frameworks enacted to stimulate investments in Electricity from Renewable Energy Sources (RES-E). TGC systems are implemented in Australia, a forerunner (MacGill, 2010), twenty nine states in USA as of 2012 (Ford et al., 2007), several European countries such as Sweden, the United Kingdom (UK), Belgium (Ringel, 2006) and recently in India (Shereef and Khaparde, 2013). In Europe, the TGC system was debated to be a superior policy framework (Bergek and Jacobsson, 2010), and has been considered as a harmonized policy option for the European electricity industry (Del Rı'o, 2005).

TGC systems are a market-based, cost-efficient and technology-neutral policy frameworks (Bergek and Jacobsson, 2010; Menanteau et al., 2003). The systems pursue varied goals in different countries, but in general term TGC schemes are to increase share of renewable sources in electricity production, drive investment in RES-E in a cost-efficient manner, and also induce innovation and technical changes (see, Bergek and Jacobsson, 2010; Haas et al., 2011a; Kildegaard, 2008). However, outcomes of TGC systems suggest that the system did not succeed to fulfill all of its objectives (Agnolucci, 2007; Bergek and Jacobsson, 2010;

Jacobsson et al., 2009). In practice, TGC systems, among others, are coupled with unbalanced competitions among renewable energy technology sectors (Menanteau et al., 2003), high investment risks due to uncertainty of both certificate and electricity prices (Toke and Lauber, 2007), and lack of equity (i.e. *the fairness in the distribution of costs and benefits between different actor groups*) (Bergek and Jacobsson, 2010: P. 1257).

To enhance performance of the TGC framework, several scholarly articles aim at assessing the outcomes of TGC systems. This line of research plays a critical role in the current electricity industry since, after more than a decade of having TGC systems, several countries including Sweden and Norway are reevaluating the systems (see, Fouquet and Johansson, 2008; Swedish Government, 2014). In this reevaluation process, findings of the scholarly articles can reveal what are the outcomes of the TGC systems in different national electricity markets. Nevertheless, a question that rises is how are TGC schemes assessed and what is the relative impact of these approaches? This paper provides an answer to this question.

The paper conducts an extensive and systematic literature review based on the Web of Science database and contributes to the literature of its nature in three main ways. Firstly, the paper provides descriptive statistics of publications on this research area. Secondly, this research sheds light on research approaches (i.e. analysis criteria), using which academic literature have assessed the performance of TGC system in stimulating larger share of RES-E. Thirdly, the paper examines the relative impact of each research approach through investigating citation records of papers.

2 Methodology

The systematic literature study of this paper is conducted through 4-step (see Figure 1). In the first step, we identified the main keywords for our study. Based on the objective of this paper to examine how scholarly articles assess the performance of TGC systems in the electricity industry, the following combination of keywords was selected: *(electricit* OR power) AND (certificate*)*. The word *power* refers to the term electric power, which often has been used as an alternative for the term electricity. We also remark that TGC systems are called differently in different countries, such as renewable electricity certificates in USA, India and Australia, renewable obligation certificates in the UK, and tradable green certificates in several European countries including the Nordic countries. In all these studies, the term certificate has been used and therefore it is a representative word for the keyword search of this paper.

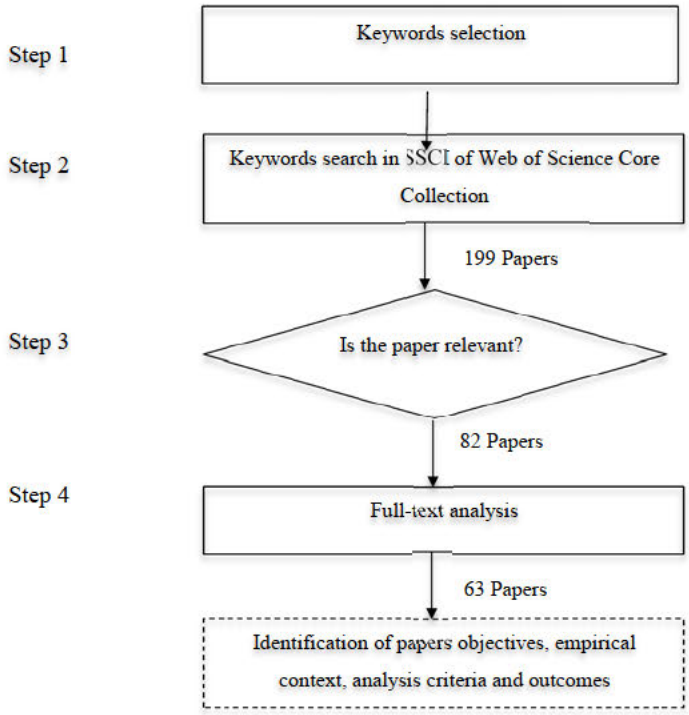

Figure 1 - Methodological steps

In the second step, we retrieved all the relevant publication from the Social Sciences Citation Index (SSCI) of Web of Science Core Collection. This database has been used by scholars for review studies commonly (e.g., Crossan and Apaydin, 2010; Karakaya and Sriwannawit, 2015; Sriwannawit and Sandström, 2015). The keyword combination was searched in the title, abstract, author keywords, and keywords plus of SSCI from 2005 to 2013. Our search yielded 199 publications.

In the third step, we read through all the publications' abstract to examine their relevancy. We only selected the papers focused on performance or design of TGC schemes. After this elimination step, 82 full-text papers were selected as relevant.

In the forth and last step, we read through the 82 papers to identify 3 main parameters regarding each paper: (1) the study's approach to analyzing performance of TGC systems, (2) country of empirical setting (3) outcome(s). In this step additional 19 publications were removed from our analyses, since the full-text analyses identified them as irrelevant. Overall, 63 publication was included in our literature study.

3 Approaches to the assessment of TGC systems performance

In the last step of our literature study, we explored the core research approaches to the assessment of TGC systems' performance in different countries, and outlined their outcomes. Though, note that it is hard to draw conclusive outcomes on the performance of TGC

systems, because of systems differences across markets (Agnolucci, 2007). We identified 7 distinct research approaches. This includes: *economy of investment, design and effectiveness of TGC system, comparative analyses of RES-E support schemes, investors diversity, TGC system as a harmonized policy framework (for EU), innovation and technical changes, and local preferences.* Table 1 illustrates the number of publication and relative impact, i.e., citation records, of each approach. The approaches are discussed in following by referring to the mostly cited articles. The approaches are listed based on the number of studies comprised in each approach, but in the followed up discussion we further draw attention to relative impact of the approaches.

Table 1- Research approaches: number of studies and relative impacts

Topic	*Number of papers*[a]	*Cumulative number of citations*	*Average citation per paper*
Economy of investments	37	652	17.62
Design and effectiveness of TGC systems	32	709	22.16
Comparative analyses of RES-E support schemes	25	683	27.32
Investors diversity	13	180	13.85
TGC system as a harmonized policy framework	8	208	26.00
Innovation and technical changes	7	223	31.86
Local preferences	3	60	20.00

[a] Note that there are several papers conducted using multiple approaches. Accordingly, the total number of papers listed in the table is not equal to 63 papers studies in this work.

3.1 Economy of investments

A first largest group of studies are dedicated to analysis of TGC system performance using economic theories and investigating economic factors behind RES-E investments. However, papers of this approach appear to have the lowest impact as relative average citations per paper suggest.

In this research approach, investors are assumed to make their decisions based on financial reasoning (Reuter et al., 2012; Unger and Ahlgren, 2005). This is to be expected, since the electricity industry is identified to be highly capital intensive (Markard and Truffer, 2006), specially after market deregulation resulting in markets driven by competitions with higher power price volatility (Högselius and Kaijser, 2010; Reuter et al., 2012). This is how TGC systems with their positive influence on profitability of firms investing in renewable electricity are identified as one of the main driving forces behind RES-E (Darmani et al., 2014; Ericsson et al., 2011; Haas et al., 2011a; Haas et al., 2011b).

However, certificate prices can vary, among others, on a basis of variations in supply of renewable power (because of their stochastic nature) (Alishahi et al., 2011; Amundsen et al., 2006), investment decisions of existing and potential competitors (Agnolucci, 2007), and changes in quota obligation (Bergek and Jacobsson, 2010; Mitchell et al., 2006). Therefore, fluctuations of certificate price whereby uncertainty are inherited in the design of TGC systems and a barrier for RES-E investments (Agnolucci, 2007; Amundsen et al., 2006; Mitchell et al., 2006).

Furthermore, TGC systems are technology-neutral encourage investments in mature and low-cost technologies. Given varied attributes of renewable energy sources and technologies (Verbruggen and Lauber, 2009), TGC schemes are coupled with uneven competition across renewable electricity technology sectors (Haas et al., 2011b; Toke, 2007). This lead to an excess profit for a group of investors (Jaraitė and Kažukauskas, 2013), such as incumbents. The excess profit is a consequence of two process: first obtaining certificates for both established plants and (or) expansion of old plants without enduring great risk, and second when investments are made in low cost technologies that are already competitive on market (Bergek and Jacobsson, 2010; Fridolfsson and Tangerås, 2013).

3.2 Design and effectiveness of TGC systems

The purpose behind a second largest share of studies on TGCs is to examine the schemes' design as well as prosperity in meeting set goals and targets. This has been referred to as analyses of TGC systems effectiveness. This study approach has high impact, a notable citation record, on studies of its nature.

Verbruggen and Lauber (2012) provide one of the most recent and extensive review on the effectiveness of TGC systems. In this study, they primary questions the technology-neutral and market-based design of TGC system by stating that (P.640): "*by design TGC overrides categorizing of RE [renewable energy] supplies for obtaining a level playing field where all RE projects irrespective of source type, technology, vintage, maturity, etc. should compete. This amalgamation is the crux of TGC markets design, and troublesome because the state of technological maturity, ownership, quality, and sustainability of various RE supplies are no longer monitored. The playing field is far from leveled and the time horizon is the rather short-term outlook*". Similar outcomes are shown in a study by Haas et al. (2011), in which they illustrate that TGC schemes stimulate investments in RES-E, although less effective on high-cost technologies and less desirable when compared with price-driven support schemes (Haas et al., 2011b).

3.3 Comparative analyses of RES-E support schemes

In several scholarly article performance of TGC system is evaluated side to side with other electricity support schemes. Less frequently but also TGC schemes performance is evaluated in a comparative study among different countries. This approach has created remarkable impact, based on its average citation records.

The papers of this approach compare performance of different renewable policy support schemes among other by (1) measuring the quantity of installed RES-E capacity, (2) estimating cost of RES-E production, (3) evaluating effectiveness of the schemes in increasing local market interests in the renewable sources of power, (4) assessing interests of local manufacturing industry to engage in RES-E production and (5) analyzing the chemes capabilities in driving technical changes and innovation (Haas et al., 2011a; Kildegaard, 2008; Ringel, 2006).

A large share of studies assess the performance of TGC in comparison with FIT (see, Agnolucci, 2007; De Jonghe et al., 2009; Finon and Perez, 2007; Jaraitė and Kažukauskas, 2013; Johnstone et al., 2010; Ringel, 2006; Verbruggen and Lauber, 2012). While it is discussed that neither of the instruments offer the absolute solution to all the criteria (Boomsma et al., 2012; Finon and Perez, 2007), a larger share of studies provide arguments in favor of FIT schemes (Alishahi et al., 2011; Fouquet and Johansson, 2008; Haas et al., 2011b; Toke and Lauber, 2007). To mention some, Fouquet and Johansson (2008: P. 4085) discuss that "*the outcome of the comparison of TGC on the one hand and FiT is apparent: end of 2006 a total of 20 GW of RE (renewable energy) capacity from wind power alone was installed in Germany, after 15 years of FiT systems. In Great Britain, just 2 GW of RE capacity was installed from wind power, after 17 years of existence of the two major quota and trade mechanisms ever established in Europe*" .

3.4 Investors diversity

Earlier the literature study of this paper showed that a large share of papers evaluate investment economies of RES-E in order to understand the logic behind firms' investment decisions for RES-E. Nevertheless, only a small share of papers acknowledges diversity of investors, in respect to their investment motivations, evaluation of investment opportunities or willingness and capabilities to endure technical, financial or regulatory uncertainty (Verbruggen and Lauber, 2012). A reason behind this small share could be that researchers are often too focused on utilities type firms, while neglecting RES-E investors diversity (see, Bergek et al., 2013). Our literature study demonstrate this negligence by finding that only a limited number of papers in our sample do consider diversity of investors when assessing

performance of TGC systems. Low impact of this approach further evidences on this negligence.

The literature study of this paper shows that investors are diverse in respect to at least three parameters: their market power (Amundsen and Bergman, 2012; Tanaka and Chen, 2013); their production size i.e., big or small capacity (Amundsen and Bergman, 2012); their risk aversion. The TGC framework would only perform effectively, if it succeeds to consider the diversity of investors.

3.5 TGC system as a harmonized policy framework (for EU)

Our analyses identified 8 papers, published between 2005 and 2008, aim at investigating the performance of a harmonized TGC system in Europe. However, this small number of papers has had a huge impact on forthcoming studies. The primarily objectives of these papers are to understand how the harmonized TGC system would effect criteria such as the system effectiveness, cost efficiency and societal dimension. A remarkable number of papers advised against the harmonized TGC system for Europe.

Jacobsson et al. (2009: P. 2143) through multi-disciplinary analyses suggest that "*a pan-EU TGC system is not the way forward for Europe*", since it would not assure greater effectiveness and dynamic efficiency . Toke (2007) discuss that a market-based EU-wide instrument would decrease the amount of local investments due to the decline in cost-effectiveness of RES-E .

3.6 Innovation and technical changes

Public policies are essential to induce technological innovation in the renewable electricity industry (Johnstone et al., 2010). In fact, technological innovation and thereby progress are essential to motivate firms to engage in projects centered on new technologies (Agnolucci, 2007). It is through investments in a new technology, that a 'learning' process happens, firms accumulate experience and in consequence cost of the technologies decrease to the level that it can compete with alternative options (Beliën et al., 2013; Neij et al., 2003; Söderholm and Sundqvist, 2007). This process of learning has been incorporated into TGC schemes' objective: to contribute to economic efficiency of technologies for RES-E and drive technical changes (e.g., Bergek and Jacobsson, 2010; Swedish Government, 2000). However, the outcomes of TGC systems suggest that the systems do not create such a condition by any mean. Although the number of papers on this topic is limited, this study approach has recorded the highest average citation per paper among other categories, showing the relevancy and high impact of this approach.

3.7 Local preferences

Performance of TGC systems is varied in different local market contexts (Madlener and Stagl, 2005). This variety has attracted a stream of studies to focus on affect of local preferences on the performance of TGC systems. Notwithstanding the relative high impact of this research approach, number of studies on this topic is limited and our analyses yielded only 3 papers.

Toke (2005) draw attentions to the importance local preference on performance by stating: "*the problem in the United Kingdom may be cultural, in that there are simply very few farmers (to date), or cooperatives, trying to deploy schemes. Whereas in Denmark, Germany, and The Netherlands there have been many local enthusiasts prepared to put a lot of time, energy, and their own money into wind-power schemes, in the United Kingdom the level of grassroots activity has been very weak*." (Toke, 2005: P. 373). Divaz-Rainey and Ashton (2008) focus on the consumer-side of market and show the certificate system have had limited success in motivating the customers to pay extra for renewable energy, due to lack of the society trust in the designed system . Raadal et al. (2012) contribute to this research stream by discussing that that electricity disclosure indeed can motivate customers to pay extra for renewable energy.

4 Conclusion

There has been a surge of motivations in academic literature to analyze the performance of policy support schemes in inducing RES-E investments. Among enacted policy schemes, TGCs have received notable attention, as it is a prevalent policy framework. Remarkable number of scholarly articles is devoted to assess the TGC systems performance in different, mainly European countries. Currently these publications play a pivotal role, since TGC support schemes are under reevaluation in several countries such as Sweden and Norway. This paper provided an extensive review of those publications pursuing three major objectives: (1) to provide a descriptive overview of the publications, (2) to explore typical approaches taken to assess the performance of TGC systems and outline their outcomes (3) to examine relative impacts of the approaches based on the publications' citation records.

The paper identified 7 main approaches including: economy of investment, design and effectiveness of TGC system, comparative analyses of RES-E support schemes, investors diversity, TGC system as a harmonized policy framework (for EU), innovation and technical changes, and local preferences. The most cited arguments for TGC system are: (1) TGC schemes succeed, to some extent, to increase the share of RES-E in different countries, (2) TGC schemes create competition among eligible technologies in the certificate market and thereby increased share of RES-E in a cost effective manner, (3) TGCs induce innovation and technical changes but in low-cost and already mature technologies.

In contrary, experience with TGC systems warn against undesirable outcomes of the systems as follow (1) TGC systems although induce further investment in mature technologies, they restrain interests in less mature technologies, (2) based on (1), TGC systems does not create condition for innovation and technical changes for less mature technologies, (3) TGC systems favor incumbent companies, (4) TGC systems induce excess profit (mainly for incumbents), increase consumers cost, and therefore cause lack of equity (5) TGCs are associated with high certificate price volatility and thereby high investment risk and (6) TGCs promote investment in larger plants more effectively than small-scale plants and that means TGC does not support investment decisions of smaller investors whose cumulative investments can play a crucial role on total RES-E produced.

Furthermore, this paper illustrated the existing gulf between available number of publications in each approach and their relative impact. For example, while there are a notable number of studies in economy of investment, their relative impact is fairly low. In contrary, the identified approach of innovation and technical changes has limited number of contributions, although the publications had high impact on forthcoming studies (a higher average citation per paper).

The findings of this work show that a large share of publications uses only two out of 6 identified approaches to assess TGC schemes performance namely: economy of investments and designs and effectiveness of TGC systems. This is while there are other approaches analyses on which lagged behind.

Lastly, outlining the publications' analyses and respective outcomes of the identified research approaches, this work indicated neglected research approaches. To illustrate the findings of this work showed that TGCs often are analyzed side-to-side to other support schemes for RES-E. It is also valuable if scholarly articles analyze the performance of TGC systems and its dynamics with counterpart support mechanism, with similar design such as emission-trading system. Analyses of this type can provide recommendations on how to improve TGC systems design, instead of arguing against TGC systems, which will be a part of current electricity markets for foreseeable future.

Acknowledgement

This research was conducted within the framework of the European Doctorate in Industrial Management (EDIM) which is funded by The Education, Audiovisual and Culture Executive Agency (EACEA) of European Commission under Erasmus Mundus Action 1 program.

Reference

Agnolucci, P., 2007. The effect of financial constraints, technological progress and long-term contracts on tradable green certificates. Energy Policy 35, 3347-3359.

Alishahi, E., Moghaddam, M.P., Sheikh-El-Eslami, M.K., 2011. An investigation on the impacts of regulatory interventions on wind power expansion in generation planning. Energy Policy 39, 4614-4623.

Amundsen, E.S., Baldursson, F.M., Mortensen, J.B., 2006. Price volatility and banking in green certificate markets. Environmental and Resource Economics 35, 259-287.

Amundsen, E.S., Bergman, L., 2012. Green certificates and market power on the Nordic power market. Energy Journal 33, 101-117.

Beliën, J., De Boeck, L., Colpaert, J., Cooman, G., 2013. The best time to invest in photovoltaic panels in Flanders. Renewable Energy 50, 348-358.

Bergek, A., Jacobsson, S., 2010. Are tradable green certificates a cost-efficient policy driving technical change or a rent-generating machine? Lessons from Sweden 2003–2008. Energy Policy 38, 1255-1271.

Bergek, A., Mignon, I., Sundberg, G., 2013. Who invests in renewable electricity production? Empirical evidence and suggestions for further research. Energy Policy 56, 568-581.

Boomsma, T.K., Meade, N., Fleten, S.-E., 2012. Renewable energy investments under different support schemes: A real options approach. European Journal of Operational Research 220, 225-237.

Crossan, M.M., Apaydin, M., 2010. A multi‐dimensional framework of organizational innovation: A systematic review of the literature. Journal of management studies 47, 1154-1191.

Darmani, A., Arvidsson, N., Hidalgo, A., Albors, J., 2014. What drives the development of renewable energy technologies? Toward a typology for the systemic drivers. Renewable and Sustainable Energy Reviews 38, 834-847.

De Jonghe, C., Delarue, E., Belmans, R., D'haeseleer, W., 2009. Interactions between measures for the support of electricity from renewable energy sources and CO 2 mitigation. Energy Policy 37, 4743-4752.

Del Río, P., 2005. A European-wide harmonised tradable green certificate scheme for renewable electricity: is it really so beneficial? Energy Policy 33, 1239-1250.

Diaz-Rainey, I., Ashton, J.K., 2008. Stuck between a ROC and a hard place? Barriers to the take up of green energy in the UK. Energy Policy 36, 3053-3061.

Ericsson, K., Nilsson, L.J., Nilsson, M., 2011. New energy strategies in the Swedish pulp and paper industry—the role of national and EU climate and energy policies. Energy policy 39, 1439-1449.

Finon, D., Perez, Y., 2007. The social efficiency of instruments of promotion of renewable energies: A transaction-cost perspective. Ecological Economics 62, 77-92.

Ford, A., Vogstad, K., Flynn, H., 2007. Simulating price patterns for tradable green certificates to promote electricity generation from wind. Energy policy 35, 91-111.

Fouquet, D., Johansson, T.B., 2008. European renewable energy policy at crossroads—Focus on electricity support mechanisms. Energy policy 36, 4079-4092.

Fridolfsson, S.-O., Tangerås, T.P., 2013. A reexamination of renewable electricity policy in Sweden. Energy Policy 58, 57-63.

Haas, R., Panzer, C., Resch, G., Ragwitz, M., Reece, G., Held, A., 2011a. A historical review of promotion strategies for electricity from renewable energy sources in EU countries. Renewable and Sustainable Energy Reviews 15, 1003-1034.

Haas, R., Resch, G., Panzer, C., Busch, S., Ragwitz, M., Held, A., 2011b. Efficiency and effectiveness of promotion systems for electricity generation from renewable energy sources–Lessons from EU countries. Energy 36, 2186-2193.

Högselius, P., Kaijser, A., 2010. The politics of electricity deregulation in Sweden: the art of acting on multiple arenas. Energy Policy 38, 2245-2254.

Jacobsson, S., Bergek, A., Finon, D., Lauber, V., Mitchell, C., Toke, D., Verbruggen, A., 2009. EU renewable energy support policy: Faith or facts? Energy policy 37, 2143-2146.

Jaraitė, J., Kažukauskas, A., 2013. The profitability of electricity generating firms and policies promoting renewable energy. Energy Economics 40, 858-865.

Johnstone, N., Haščič, I., Popp, D., 2010. Renewable energy policies and technological innovation: evidence based on patent counts. Environmental and Resource Economics 45, 133-155.

Karakaya, E., Sriwannawit, P., 2015. Barriers to the adoption of photovoltaic systems: The state of the art. Renewable and Sustainable Energy Reviews 49, 60-66.

Kildegaard, A., 2008. Green certificate markets, the risk of over-investment, and the role of long-term contracts. Energy Policy 36, 3413-3421.

MacGill, I., 2010. Electricity market design for facilitating the integration of wind energy: Experience and prospects with the Australian National Electricity Market. Energy Policy 38, 3180-3191.

Madlener, R., Stagl, S., 2005. Sustainability-guided promotion of renewable electricity generation. Ecological Economics 53, 147-167.

Marchenko, O., 2008. Modeling of a green certificate market. Renewable Energy 33, 1953-1958.

Markard, J., Truffer, B., 2006. Innovation processes in large technical systems: Market liberalization as a driver for radical change? Research Policy 35, 609-625.

Menanteau, P., Finon, D., Lamy, M.-L., 2003. Prices versus quantities: choosing policies for promoting the development of renewable energy. Energy policy 31, 799-812.

Mitchell, C., Bauknecht, D., Connor, P.M., 2006. Effectiveness through risk reduction: a comparison of the renewable obligation in England and Wales and the feed-in system in Germany. Energy Policy 34, 297-305.

Neij, L., Andersen, P.D., Durstewitz, M., Helby, P., Hoppe-Kilpper, M., Morthorst, P.E., 2003. Experience curves: a tool for energy policy assessment. Environmental and Energy Systems Studies, Univ.

Raadal, H.L., Dotzauer, E., Hanssen, O.J., Kildal, H.P., 2012. The interaction between electricity disclosure and tradable green certificates. Energy Policy 42, 419-428.

Reuter, W.H., Szolgayová, J., Fuss, S., Obersteiner, M., 2012. Renewable energy investment: Policy and market impacts. Applied Energy 97, 249-254.

Ringel, M., 2006. Fostering the use of renewable energies in the European Union: the race between feed-in tariffs and green certificates. Renewable energy 31, 1-17.

Shereef, R., Khaparde, S., 2013. Current status of REC mechanism in India and possible policy modifications to way forward. Energy Policy 61, 1443-1451.

Söderholm, P., 2008. The political economy of international green certificate markets. Energy Policy 36, 2051-2062.

Söderholm, P., Sundqvist, T., 2007. Empirical challenges in the use of learning curves for assessing the economic prospects of renewable energy technologies. Renewable energy 32, 2559-2578.

Sriwannawit, P., Sandström, U., 2015. Large-scale bibliometric review of diffusion research. Scientometrics 102, 1615-1645.

Swedish Government, 2000. Ekonomiska förutsättningar för elproduktion från förnybara energikällor (‘‘Economic conditions for electricity production from renewable energy sources’’), Government Bill (prop. 1999/2000:134), 20 May 2000,Stockholm (inSwedish).

Swedish Government, 2014. Regeringens proposition 14/15:110 om ambitionshöjning för förnybar el och kontrollstation för elcertifikatssystemet 2015.

Tanaka, M., Chen, Y., 2013. Market power in renewable portfolio standards. Energy Economics 39, 187-196.

Toke, D., 2005. Are green electricity certificates the way forward for renewable energy? An evaluation of the United Kingdom's Renewables Obligation in the context of international comparisons. Environment and Planning C: Government & Policy 23, 361-374.

Toke, D., 2007. Renewable financial support systems and cost-effectiveness. Journal of Cleaner Production 15, 280-287.

Toke, D., Lauber, V., 2007. Anglo-Saxon and German approaches to neoliberalism and environmental policy: The case of financing renewable energy. Geoforum 38, 677-687.

Unger, T., Ahlgren, E.O., 2005. Impacts of a common green certificate market on electricity and CO 2-emission markets in the Nordic countries. Energy Policy 33, 2152-2163.

Verbruggen, A., Lauber, V., 2009. Basic concepts for designing renewable electricity support aiming at a full-scale transition by 2050. Energy Policy 37, 5732-5743.

Verbruggen, A., Lauber, V., 2012. Assessing the performance of renewable electricity support instruments. Energy policy 45, 635-644.